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NOTES ON TWO GENERA OF ECTOPARASITIC TREMATODES FROM FRESH-WATER FISHES *

H. J. Van Cleave

Because of their economic importance the trematodes infesting the general body surface and gills of fishes have received considerable attention at the hands of European investigators. In spite of their importance, there have been extremely few records of their occurrence on fresh-water fishes of North America. Many of the ectoparasitic trematodes are so minute and in life are so translucent that they entirely escape detection by the casual observer or the general collector. With few exceptions the records of ectoparasitic trematodes from fresh-water fishes of North America assume the specific identity of the North American and European forms, as indicated in the following summary:

A trematode epidemic among young fishes under cultural conditions and a general infestation of the wild native fishes were reported from the Craig Brook Station, Maine, in the report of the U. S. Commissioner of Fish and Fisheries for 1899. In this instance no clue is given to the species or even to the genus of the parasites. Later (1901), C. G. Atkins in writing of the same epidemic attributed the parasites to the species *Gyrodactylus elegans*.

Pratt (1919: 7) mentions an infection "discovered on the gills of the rainbow trout in the New York State hatchery at Cold Spring Harbor, Long Island. Practically all the trout a year old or more were infected, in many instances in such large numbers that the gills were shriveled and functionless." In this connection Pratt has given a generalized figure of a representative of the genus Gyrodactylus but no specific determination of the parasite.

As a result of his studies on Canadian fresh-water fishes, Cooper (1915:190) reported the occurrence of four species of ectoparasitic trematodes from this continent. In his collections three genera: Gyrodactylus, Ancyrocephalus, and Diplobothrium, were represented. But a single specimen of Gyrodactylus was encountered in the course of his work. This individual was ascribed to the species *G. medius* Katthariner, but in his discussion Cooper brings out data which seem to preclude the possibility of his specimen belonging to this species. He mentions that "The large hooks in the posterior disc, however, are relatively simpler and larger than in Kathariner's *G. medius* and *G. gracilis* being

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54μ in length. They and the sixteen smaller peripheral hooks, each 34μ in length, compare more favorably, as to size, with Wegener's description of *G. elegans* v. Nord." The present writer has encountered specimens which seem to agree with Cooper's description and has been unable to find any previously described species of Gyrodactylus with which these individuals can be considered as identical.

During the summer of 1919, the writer was engaged in an investigation of the parasitic worms which infest fresh-water fishes at the Fairport Biological Station of the U. S. Bureau of Fisheries. In the course of routine examinations of fishes a number of instances of ectoparasitic trematode infestations were encountered. Under conditions of nature the opportunity for an ectoparasitic trematode outbreak to become serious is relatively small. On the other hand, when fishes are confined in ponds and pools in much denser population than occurs in nature, especially favorable conditions are given for development of heavy general infestation. Young fish in hatcheries thus have unusual opportunities for acquiring ectoparasitic trematodes, if such are present in the environment. Thereby, these parasites are transported to new localities by the distribution of the infested fishes.

The writer is deeply indebted to the members of the staff of the Fairport Station for aid in securing materials for study and is under especial obligation to Dr. H. S. Davis who first called his attention to the presence of ectoparasitic trematodes on the fishes which were being used in experimental work at the station. According to observations by Dr. Davis, trematodes have been fairly abundant on the gills of various species of fish from the cultural ponds and tanks at Fairport for a number of seasons.

Genus Gyrodactylus von Nordmann 1832

Small, spindle-shaped or cylindrical trematodes, usually less than 1 mm. long, living on the body surface or gills of fresh-water fishes. The two extremities of the body furnish characters for the separation of Gyrodactylus from other genera of ectoparasitic trematodes. In this genus the body terminates anteriorly in two small papillae while the posterior extremity is modified as an organ for attachment to the host. This organ of fixation (Figs. *a b,* text fig. 1) is a broadly expanded disc which bears two long, powerful hooks in the center and a series of 16 small spines arranged in a single row about its margin. The mouth occurs on the ventral surface some distance behind the anterior extremity. Eyespots, which are found in some genera of the family Gryodactylidae, are wanting in this genus. The eggs undergo development within the body of the parent and give rise to young individuals which are capable of infesting the fish without passing a larval existence in any intermediate host.

On August 20, 1919, the writer encountered an infestation by a member of this genus that seems to be significant. On the day preceding, about a dozen young catfishes, *Ameiurus melas* (Raf.) * had been removed from the Quarry Pond of the Fairport Station to a running water aquarium in the laboratory. In less than 24 hours after their removal to the laboratory a number of the fishes had died. A careful examination of the dead fishes failed to bring out any possible cause of death other than the presence of small trematodes of the genus Gyrodactylus scattered over the entire surface of the body. All of the fish in the aquarium were examined and found to be infected with this same parasite. After a preliminary study of the living worms the infected fish were placed in hot corrosive sublimate and the parasites preserved for later study. Thorough examination of these specimens has demonstrated that they belong to a species previously undescribed. To this new species the name *Gyrodactylus fairporti* is ascribed and the distinguishing characters are set forth in the following diagnosis.

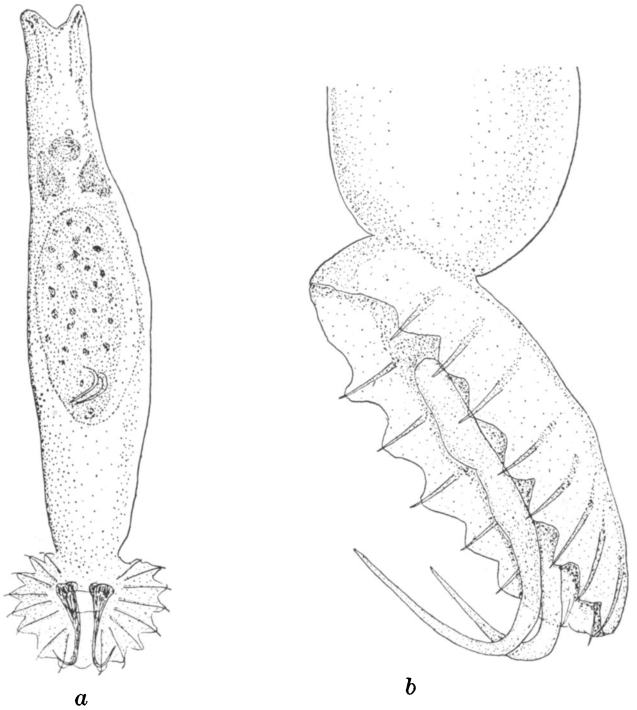

Fig. 1.—*a, Gyrodactylus fairporti* sp. n., stained whole mount from ventral surface. Camera lucida drawing. x290. *b, G. fairporti,* posterior attachment disc slightly tilted ventrad and viewed from the side. x 830.

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* Mr. R. E. Richardson very kindly identified the host specimens.

Gyrodactylus fairporti new species

Gyrodactylus: In general form the central hooks of *G. fairporti* resemble those of *G. medius* Kath. (Cf. *a, b,* Text fig. 2). However, in *G. fairporti* these hooks are much simpler in form, are considerably longer, and throughout the length of the root-like portion are much less divergent than in *G. medius*. In *G. medius* the basal portions of these hooks approach each other at a single point near the place where the hooks bend ventrally to form the free, exposed region, while in *G. fairporti* the entire basal regions are almost parallel except at the proximal extremity and here occurs a slight bending toward the median line. The transverse clamps which serve as a means of articulation between the two hooks are much more prominent in *G. medius* than in *G. fairporti*. Wegener (1910) in giving the measurements of the central hooks of *G. medius* gave a range in length of from 37 to 40μ. In 50 individuals of *G. fairporti* the writer found the smallest hooks to be 53μ long and the longest 65μ. Hooks of the greatest number of individuals ranged between 59 and 62μ.

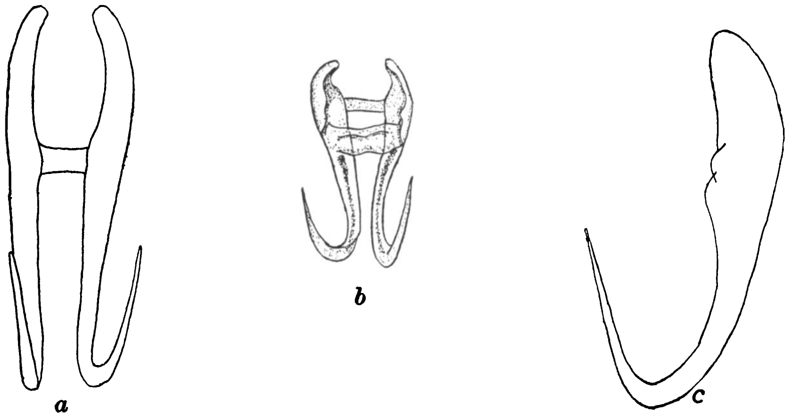

Fig. 2.—*a,* Ventral view of central hooks of *G. fairporti,* × 830. *b,* Central hooks of *Gyrodactylus medius* Kath. After Kathariner (1894, fig. 8). Magnification not in original; figure cannot be compared directly with *c*. *c,* Side view of central hook from *G. fairporti*. x 830.

Other described species of Gyrodactylus present such distinctively different types of hooks that there is small chance of confusing any of them with either *G. medius* or *G. fairporti* if a careful examination of the hooks is made. For this reason no especial effort is made in this description to compare the hooks of *G. fairporti* with those of species other than *G. medius*. Attention should be called to the fact that the measurements of the hooks of *G. medius* Kath. are taken from the work of G. Wegener (1910) even though that author indicated some doubt as to the correctness of the determination of the materials which he described under that name. The fact that the form with which he was dealing is one of the common species in central Europe and that his figures and descriptions agree so completely with those of the author of the species seem ample ground for assuming that his determination of the species was correct. The works of subsequent writers have failed to bring forth evidence of the presence of additional species of the genus in Europe closely resembling the species *G. medius.*

The small marginal spines of the posterior disc are very difficult to measure because of foreshortening due to the sloping margins of the disc and because of the fact that their proximal terminations are very indefinitely defined. In some individuals they were not more than 20μ long while in still others from the same host they were more than 30μ long.

Preserved specimens of *G. fairporti* are usually between 0.350 and 0.450 mm. in length. The maximum diameter of these same specimens varies from 0.050 to 0.075 mm. Practically all of the larger individuals carry an embryo in a fairly late stage of development (Fig. *a,* Text fig. 1).

Hosts: *Ameiurus melas* (Raf.) and *Cyprinus carpio* Linn. at Fairport, Iowa, from Quarry pond and culture ponds. Parasites attacking entire body surface of Ameiurus and appearing chiefly on gills of the carp.

Cotypes deposited in the U. S. National Museum, in the collection of the writer at Urbana, Illinois, and in the parasitological collection of the University of Illinois.

Genus Ancyrocephalus Creplin 1839

Throughout the months of July and August light infestations by an undetermined species of Ancyrocephalus were observed on the gills of various fishes from the ponds of the Biological Station. At the time these observations were being made this parasite was encountered most frequently and in greater numbers upon the gills of *Lepomis pallidus* though many other fishes were found to carry an infestation. Among other hosts observed at Fairport are *Ictalurus punctatus, Lepomis humilis,* and *Micropterus salmoides.* The gills of a specimen of *Esox lucius* from Lake Pokegama, Minnesota, displayed a heavier infestation than any encountered at Fairport. In preserved material the posterior extremity bearing the hooks and spines was so firmly embedded in the gill tissues of the host that details of structure essential for determination of the species were inaccessible.

On two other occasions members of the genus Ancyrocephalus have been reported from fresh water fishes of North America. Both of these earlier records resulted from work done on Canadian fishes.

J. Stafford (1905: 681) recorded the occurrence of *Tetraonchus unguiculatus* Wag. (= *Ancyrocephalus paradoxus* Crepl.) from *Ambloplites rupestris* and *Eupomotis gibbosus*. He has given no figures or other data in confirmation of his determination. A. R. Cooper (1915: 190) has recorded the occurrence of the same species on the gills of *Micropterus dolomieu* and identified other specimens from the same host species as *Ancyrocephalus cruciatus* (Wedl.). In both of these instances he has pointed out rather significant differences between his specimens and the descriptions of the species offered by European investigators. It is not improbable that further study would furnish additional points of difference between the North American and European representatives of this genus.

Worms of this genus do not seem to develop dangerous infestations such as are reported for the genus Gyrodactylus and are consequently of less importance economically.

TREATMENT OF INFESTED FISHES

Heavy infestations of Gyrodactylus may result in serious disturbances to the host. Unless relief is afforded death of the host is the usual outcome. Pratt, as already quoted, has mentioned the shriveled and functionless condition of the gills in a heavy infestation of rainbow trout by Gyrodactylus. Damage to the general surface of the body is not restricted to the direct damage due to piercing of the body covering by the hooks and spines. Inroads of bacteria, protozoa, and fungi are made possible by the lacerations produced by the hold-fast organs.

Fishes infested with Gyrodactylus are conspicuously inactive and weak. They allow the gill covers to remain much wider open than in the normal condition (Hofer, 1906: 135). These, with other symptoms, European investigators have associated with Gyrodactylus infestation and to this pathological condition have applied the name Gyrodactyliasis or Gyrodactylus disease. Since the disease is apt to develop in aquaria and artificial enclosures rather than in the natural open waters, methods of direct treatment of the diseased fish are applicable. European workers have advocated a number of different methods of treatment for removing the parasites. All of these measures involve subjecting the parasitized fish to solutions of substances that are fatal to the parasites without harming the host. Conditions under which such treatment may be carried out vary so widely that wholesale operations of any sort are inadvisable until the individual method has been tested out. Temperature of the water and differences in the susceptibility of fishes of different species and different ages offer obstacles that make an empyrical formula for treatment not only unwise but also unsafe.

Hübner (1895: 191) has recommended a one-fourth of one per cent. solution of salicylic acid in which the infested fish are allowed to stand for one-half hour. Hofer (1906: 137) advocates this same treatment and in addition suggests another formula which he considers as of value, viz., one part of potassium permanganate to 100,000 parts of water.

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